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(54) OPTICAL DISK MEDIUM AND OPTICAL DISK APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an optical disk medium and an optical disk apparatus wherein alternate areas are scattered in a zone so that a move distance of an information recording/reproducing head is reduced when an alternate process takes place.

SOLUTION: In an optical disk divided to a plurality of zones each including m (m is an integer) track each track in the zone is divided to n (n is an integer) sectors which are constant in each zone and larger as the zone is closer to an outer circumference. A block as a unit in processing data is constituted of s (s is a constant integer in the optical disk) sectors. An alternate area comprised of $k \times s$ (k is an integer) sectors is added to an area comprised of $p \times s$ sectors which is a collection of p blocks (p is an integer) to satisfy $p+k=2q$ (q is an integer).

CLAIMS

[Claim(s)]

[Claim 1] It is divided into two or more zones according to a radial position and each above-mentioned zone in optical disk media including m tracks (m is an integer) respectively each track in the above-mentioned zone. For every zone it is fixed and is subdivided by n sectors (n is an integer) into which it increases as a zone located in the periphery side. A block which is a unit at the time of processing data comprises s sectors (s is an integer with s constant within the above-mentioned optical disk media). The back up area which consists of $k \cdot s$ sectors (k is an integer) is added to a field which consists of $p \cdot s$ sectors which collected p blocks (p is an integer) and it is $p+k = 2^q$ (q is an integer).

Optical disk media wherein ** satisfactory is carried out.

[Claim 2] Are divided into two or more zones according to a radial position and each above-mentioned zone is optical disk media including m tracks (m is an integer) respectively and each track in the above-mentioned zone. For every zone it is fixed and is subdivided by n sectors (n is an integer) into which it increases as a zone located in the periphery side. A block which is a unit at the time of processing data comprises s sectors (s is an integer with s constant within the above-mentioned optical disk media). The back up area which consists of $k \cdot s$ sectors (k is an integer) is added to a field which consists of $p \cdot s$ sectors which collected p blocks (p is an integer) and it is $p+k = 2^q$ (q is an integer).

An optical disk unit having a means to access the nearby back up area in an optical disk unit which performs alternating processing of optical disk media by which ** satisfactory is carried out when alternating processing occurs in Data Recording Sub-Division to said optical disk media.

[Claim 3] In optical disk media divided into two or more zones according to a radial position. Optical disk media making the back up area for constituting two or more error correction blocks from a sector arranging this error correction block so that two or more zones may not be straddled and performing alternating processing further into a size of a number of a sector of integral multiples which constitute said error correction block.

[Claim 4] The optical disk media according to claim 3 having arranged said back up area uniformly all over a data area.

[Claim 5] In an optical disk unit which rotates optical disk media divided into two or more zones according to a radial position. An optical disk unit which constitutes two or more error correction blocks from a sector arranges this error correction block so that two or more zones may not be straddled and arranges the back up area for performing alternating processing further so that it may become a size of a number of a sector of integral multiples which constitute said error correction block.

[Claim 6]The optical disk unit according to claim 5 having arranged said back up area uniformly all over a data area.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the optical disk unit which performs record reproduction etc. using the optical disk media and it which were divided into two or more zones according to the radial position.

[0002]

[Description of the Prior Art]In recent yearsthe sector arrangement method with various optical discs is proposed. One of them has a ZCLV method. Drawing 7 is a figure showing the composition of the format disk of a ZCLV (Zoned Constant Linear Velocity: linear velocity regularity in field) method. The ZCLV method is dividing the optical disc into two or more fields (it is called a zone below.) according to a radial position.

Each zone has a peculiar sector numberrespectivelyand the sector numbers contained on a track for every zone differ.

The optical disc shown in drawing 7 is the exampleand whenever it moves from the zone by the side of inner circumference to the zone by the side of one peripheryone sector number around one track increases it. In the figurewhen the zone which continued from the inner circumference side is made into a zone (k-1)the zone kand a zone (k+1)the case where the sector number is set to 34and 5respectively is shown. And in each zonethe sector-address field including the address information of each sector is arranged so that it may stand in a line on a straight line radially.

[0003]Herethe width of such a zone is decided that the storage density of the most inner circumference of each zone becomes fixedfor example. Drawing 8 is a figure showing the example of specification of the conventional optical disk media. Hereas shown in a figurethe disc medium has six zones from 0 to 5. As for Data Recording Sub-Divisionthe zone of the most inner circumference begins from 24 mm of radius distances from a disk center. The sector number per [in a zone] one track in the most inner circumference is 20. In this casethe minimum sector length is set to $24.000 \times 2\pi / 20 = 7.540$ (mm). The radius x (mm) of the most inner circumference of the next zone is asked for 25.2 (mm) from the formula of $x \times 2\pi / 21 = 7.540$ (mm). When a track pitch sets to 1 (micrometer)the track number in a zone is called for with $(25.2 - 24.0) / 0.001 = 1200$. It can ask similarly about the zone by the side of a periphery below.

[0004] Thus when a zone interval is searched for the minimum sector length in a zone becomes fixed and can raise storage density efficiently using the shortest pit length which can record up until last minute. In order to perform record reproduction etc. as mentioned above on the other hand in each zone by making the sector number and the minimum sector length per track into a predetermined value when the zone to access changes it will be necessary to change the number of rotations of an optical disc in step (when accessing ranging over a zone). For this reason it must be made a waiting state without performing record reproduction etc. until the disk rotational frequency after a zone change is stabilized.

[0005] Now it is common to perform processing which made the block of an error correction interleave etc. the unit on the other hand in carrying out record reproduction of video information the speech information etc. to an optical disc. And a block is usually constituted over two or more sectors. Therefore if a block may be constituted ranging over a zone and tends to carry out record reproduction of such a block it will be necessary to access ranging over between zones. That is since processing made into the unit is performed in the block of an error correction interleave etc. as for data when carrying out writing/read-out to the block over a zone in order to complete writing/read-out of this block a zone changes and the time lag accompanying the re set of a disk rotational frequency is sometimes produced.

[0006] In the device which performs record reproduction etc. using the conventional optical disk media which were mentioned above the table for pinpointing the zone and block position where this sector belongs from a sector address since the block may be straddling the zone border is provided. It is constituted so that the zone and block position of a sector which should perform writing/read-out may be obtained by referring to this table.

[0007] Optical disk media have provided a field called the back up area to the disk defect. This field is a field in which the sectors used instead of that sector gathered when a defect sector is found. The back up area is established in the both ends and zone border part of a user data area in many cases so that it may be specified also to the diameter of 90 mm and 230 M bytes of optical disc standard of STANDARD ECMA-201.

[0008]

[Problem(s) to be Solved by the Invention] Since it was constituted as mentioned above the zone changed and the conventional optical disk media sometimes had the problem of producing the time lag accompanying the re set of a disk rotational frequency in order to complete writing/read-out of this block when writing/read-out was carried out to the block over a zone.

[0009] Since the block may be straddling the zone border conventional optical disk media and optical disk unit had the problem that it was necessary to have

a table for pinpointing the zone and block position where this sector belongs from a sector address.

[0010] Since it was collectively arranged by the back up area before and behind the zone the conventional optical disk media had the problem that the migration length to the back up area of the Information Storage Division playback head was large when alternating processing occurred.

[0011] When it was made in order that this invention might solve the above problems and carrying out writing/read-out to the block over a zone it aims at obtaining the optical disc which the zone for completing writing/read-out of this block changes and the time lag accompanying the re set of a disk rotational frequency does not sometimes produce.

[0012] It aims at obtaining the optical disk media and the optical disk unit which can pinpoint easily the zone where the sector belongs and a block position from the sector address of a sector which should perform writing/read-out.

[0013] Migration length of the Information Storage Division playback head accompanying sector alternating processing is lessened and it aims at obtaining the optical disk media which can access the back up area immediately and can perform alternating processing.

[0014]

[Means for Solving the Problem] In optical disk media with which the optical disk media according to claim 1 are divided into two or more zones according to a radial position and each above-mentioned zone includes m tracks (m is an integer) respectively. Each track in the above-mentioned zone is constant for every zone and it is subdivided by n sectors (n is an integer) into which it increases as a zone located in the periphery side. A block which is a unit at the time of processing data comprises s sectors (integer with s constant within the above-mentioned optical disk media). The back up area which consists of $k \cdot s$ sectors (k is an integer) is added to a field which consists of $p \cdot s$ sectors which collected p blocks (p is an integer) and it is $p + k = 2^q$ (q is an integer).

** satisfactory is carried out.

[0015] The optical disk unit according to claim 2 is divided into two or more zones according to a radial position. Each above-mentioned zone is m tracks (m is an integer) included optical disk media respectively and each track in the above-mentioned zone. For every zone it is fixed and is subdivided by n sectors (n is an integer) into which it increases as a zone located in the periphery side. A block which is a unit at the time of processing data comprises s sectors (integer with s constant within the above-mentioned optical disk media). The back up area which consists of $k \cdot s$ sectors (k is an integer) is added to a field which consists of $p \cdot s$ sectors which collected p blocks (p is an

integer) and it is $p+k = 2^q$ (q is an integer).

In an optical disk unit which performs alternating processing of optical disk media by which ** satisfactory is carried out when alternating processing occurred in Data Recording Sub-Division to said optical disk media it had a means to access the nearby back up area.

[0016] In optical disk media with which the optical disk media according to claim 3 were divided into two or more zones according to a radial position Two or more error correction blocks were constituted from a sector this error correction block has been arranged so that two or more zones may not be straddled and the back up area for performing alternating processing further was made into a size of a number of a sector of integral multiples which constitute said error correction block.

[0017] The optical disk media according to claim 4 have arranged uniformly the back up area in the optical disk media according to claim 3 all over a data area.

[0018] In an optical disk unit with which the optical disk unit according to claim 5 rotates optical disk media divided into two or more zones according to a radial position Two or more error correction blocks were constituted from a sector this error correction block has been arranged so that two or more zones may not be straddled and the back up area for performing alternating processing further has been arranged so that it may become a size of a number of a sector of integral multiples which constitute said error correction block.

[0019] The optical disk unit according to claim 6 has arranged uniformly the back up area in the optical disk unit according to claim 5 all over a data area.

[0020]

[Embodiment of the Invention] Hereafter this embodiment of the invention is concretely described based on a figure.

Embodiment 1. drawing 1 shows the top view of the optical disk media which are this embodiment of the invention 1. These optical disk media 1 have a track of the spiral shape (spiral) consisting mainly of the track of a circle configuration or the rotation center point 2 almost which surrounds the rotation center point 2 in same mind and is located. The optical disk media 1 are divided into the zone which are two or more annular regions according to a radial position and each above-mentioned zone has m tracks (m is an integer). If it puts in another way the track of the optical disk media 1 will be arranged at the group which consists of m adjacent tracks (m is an integer) and these groups will form one zone respectively. In drawing 1 four in these zones were shown and the numerals 3, 4, 5 and 6 were given to these zones.

[0021] Each track is subdivided by the n sectors (n is an integer) 7 and these sectors have a channel bit of the equal number mutually. And in each zone the

number n of the sector of per one track (1 winding) is set constant and the number n of the sector is formed as the zone located in the periphery side so that it may increase. Each sector has what is called the header part and control informations such as a sector address which controls writing/reading of information is written in this header part. In each zone the header part of the sector has aligned in the disk radial (in-line-izing). Furthermore each sector has a data part which User Information is written in or can read User Information.

[0022] Drawing 2 is a figure showing the composition of the zone of the optical disk media which are this embodiment of the invention 1. A block collects s sectors (integer with s constant within the above-mentioned optical disk media). And as for the data recorded on the data part at least variety-of-information processing is performed considering this block as a unit. For example it is adding error correcting codes such as RS (Reed Solomon) inner code and numerals outside RS or carrying out interleave processing etc. Some data of a header unit may constitute one packed data from a block unit.

[0023] And a block is constituted so that the total of the sector in each zone may serve as an integral multiple of the sector number contained in one block. If it puts in another way in each zone the conditions of $n-m=j-s$ (j is an integer) will be satisfied. The number of a track [in / in m / a zone] and n show the number of the sector per one track here respectively. s shows the sector number contained in one block and is constant within optical disk media. As a result the block of integer pieces will exist in each zone and it is lost that one block straddles two zones between zones.

[0024] Drawing 3 is a figure showing the example of specification of the optical disk media which are this embodiment of the invention 1. Data recording regions are classified into six zones in this example. 1184 and the sector number n per track of the number m of a track [in / in several s of the sector contained in one block / 32 and a zone] are 20 to 25 in order of an inner circumference zone to a periphery zone.

[0025] By specifying the number m of the track in a zone and the sector number n per track several s of the sector contained in one block as mentioned above Since the block over between zones is lost and the change (it is necessary to change disk rotational speed if a zone changes) of a disk rotational frequency etc. do not arise to one block writing / when carrying out reading In order to complete writing/read-out a zone changes and the time lag accompanying the re set of a disk rotational frequency does not sometimes arise. By taking sector number s which constitutes a block to 2^{s1} the high order bit except the low rank $s1$ bit of the sector address can make the relative address which low rank $s1$ bit is blocking correspond to a block address again respectively and management of a block becomes easy.

[0026]The optical disk unit which processes record reproduction etc. using the optical disk media explained in the embodiment 2. above-mentioned embodiment 1 is made into Embodiment 2 and is explained below. Drawing 5 is a block diagram showing the composition of the optical disk unit which is this embodiment of the invention 2. A disk motor for 1 to rotate an optical disc and for 9 make a disk rotate in a figureThe Information Storage Division playback head in which 10 carries out record reproduction of the data to an optical disc and in which movement in each zone of a disk is possibleThe motor-rotation-frequency control means which controls 11 to the number of rotations which was suitable for the zone under record reproduction using the motor-rotation-frequency information from an address translation treating part12 specifies the zone and block to which the sector belongs with the record reproduction address from the outsideThe track information corresponding to the position of the Information Storage Division playback head corresponding to it to the Information Storage Division playback head 10. The address translation treating part which outputs motor-rotation-frequency information to the motor-rotation-frequency control means 11respectively13 outputs record data to the Information Storage Division playback head 10 with a record gating signal (not shown) at the time of recordand it is a record reproduction means which reads a regenerative signal from the Information Storage Division playback head 10 with a reproduction gating signal (not shown) at the time of reproduction.

[0027]Drawing 4 is a figure showing an example of the relation of the sector address in the optical disk media used with the optical disk unit which is this embodiment of the invention 2a block addressand a zone address. As for the optical disk media used hereone block is formedfor example with four sectorsandin the zone of four blocks and the zone address 1the zone of the zone address 0 consists of five blocks.

[0028]Next how to determine a block address and a zone address from a sector address in the address translation treating part 12 is explained. A block address is obtained by dividing the sector address of the sector which carries out record reproduction first by the number of the sector which constitutes a block. For examplewhen a sector address is 22it is set to two $22 / \text{about in } 4 = 5$ and a block address is obtained as the dealer 5 in integers (integral part of a quotient). Furthermore remainder will show the relative location in the block with which the sector belongs. In the case of a previous exampleremainder is 2 and the 3rd relative location (since it starts with No. 0it becomes the 2+1st) is obtained during a block. When it is actually going to access the 22nd sector (a sector address is a sector of 22)thisIn order to process the error correcting code added and generated by the block unit in the error correction circuit (not shown) established in the latter part of the record reproduction means 13it is necessary to accessthe blocks 20-23i.e. the sector

addresses containing the sector. Although it is necessary to ask for the block address which contains the sector in processing of such an error correction etc. from the sector address which it is going to access it can ask for the block address which contains the sector from a sector address as mentioned above immediately and easily.

[0029] It asks for a zone address from a block address. Since it comprises this example so that a block may always increase by one whenever one zone address increases in number when each address should begin from "0" and a block address is set to k the greatest n that fills $k \geq (n \times n + 9 \times n + 6) / 2$ is a zone address. Thus it can draw easily by calculation without a block address and a zone address providing a table etc. separately from a sector address.

[0030] The optical disk media which are the embodiment 3. embodiments 3 are explained. Drawing 6 is a figure showing the composition of the zone of the optical disk media which are this embodiment of the invention 3. And as for the data recorded on the data part at least variety-of-information processing is performed considering this block as a unit. For example it is adding error correcting codes such as RS (Reed Solomon) inner code and numerals outside RS or carrying out interleave processing etc. Some data of a header unit may constitute one packed data from a block unit.

[0031] And the becoming [an end of the field which consists of $s \cdot p$ sectors which collected p blocks (p is an integer)] - from $k \cdot s$ sectors (k is integer) back up area is added and it is $p \cdot k = 2^q$ (q is an integer).

It constitutes so that it may be satisfied. This drawing 6 shows the case where it takes to $p = 7$, $k = 1$ and $q = 3$ for example. Thus the back-up-area part conventionally arranged collectively by arranging the back up area at the anterior part of a block and the rear will be uniformly arranged all over a data area. Also when alternating processing occurs in Data Recording Sub-Division movement of the Information Storage Division head can be lessened the back up area can be accessed immediately and alternating processing can be performed. Since 2^q is arranged as a unit and the block in which all the low rank q bits of a block address are set to "1" will serve as the back up area in the arrangement if a block address shall begin from 0 for example the address administration of the back up area becomes easy.

[0032] Such alternating processing is generated when correction is impossible also by error correction processing. When the error correcting code is added not by a sector unit but by the block unit and error correction processing is impossible alternating processing is also performed by a block unit. For this reason futility is not produced in address space by making the back up area into size $s \cdot k$ of the integral multiple of a block.

[0033]

[Effect of the Invention] Since this invention is constituted as explained

above it does an effect as taken below so.

[0034] According to the invention of claim in this application 1 and 2 the block over between zones is lost. When carrying out writing/read-out to the block in a zone border the zone for completing writing/read-out of this block changes and the time lag accompanying the re set of a disk rotational frequency can sometimes be abolished. The zone and block position where the sector belongs from the sector address of a sector which should perform writing/read-out can be pinpointed easily without address administration's becoming easy and preparing a table etc. separately.

[0035] According to the invention of Claims 3 and 5 the block over between zones is lost. When carrying out writing/read-out to the block in a zone border the zone for completing writing/read-out of this block changes and the time lag accompanying the re set of a disk rotational frequency can sometimes be abolished. Since the back up area was made into the size of the integral multiple of a block a record feasible region is efficiently securable.

[0036] By arranging arrangement of the back up area uniformly all over the data area of optical disk media according to the invention of Claims 4 and 6 also when alternating processing occurs at the time of record etc. movement of the Information Storage Division playback head can be lessened the back up area can be accessed immediately and alternating processing can be performed.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a figure showing the top view of the optical disk media which are this embodiment of the invention 1.

[Drawing 2] It is a figure showing the composition of the zone of the optical disk media which are this embodiment of the invention 1.

[Drawing 3] It is a figure showing the example of specification of the optical disk media which are this embodiment of the invention 1.

[Drawing 4] They are a sector of the optical disk media used with the optical disk unit which is this embodiment of the invention 2a block and a figure showing an example of the relation of each address of a zone.

[Drawing 5] It is a block diagram showing the composition of the optical disk unit which is this embodiment of the invention 2.

[Drawing 6] It is a figure showing the composition of the zone of the optical disk media which are this embodiment of the invention 3.

[Drawing 7] It is a figure showing the composition of the format disk of a ZCLV method.

[Drawing 8] It is a figure showing the example of specification of the

conventional optical disk media.

[Description of Notations]

1 Optical disk media and 2 [The Information Storage Division playback head11
motor-rotation-frequency control means 12 address-translation treating partand
13 / Record reproduction means.] A rotation center pointand 3-6 A zone and 7
A sector8 header partsnine disk motorsand 10
